CLAIMS

What is claimed is:

1. An intermediate frequency sampling architecture, comprising:

a modulator, the modulator receiving an input signal and modulating the input signal to an intermediate frequency;

a first filter, the first filter receiving the intermediate frequency signal and passing the intermediate frequency signal through a filter having a bandpass characteristic, producing a filtered signal; and

a quantizer, the quantizer receiving the filtered signal and digitizing the filtered signal producing a digitized signal ready for baseband conversion.

2. The radio of claim 1, wherein the intermediate frequency sampling architecture further comprises a second filter, the second filter receiving the input signal and filtering the input signal prior to modulating the input signal to an intermediate frequency.

3. The radio of claim 2, wherein the intermediate frequency sampling architecture further comprises an I/Q sampler, the I/Q sampler receiving the filtered signal, and providing extra selectivity on the signal for input into the quantizer.

4. The radio of claim 3, wherein the I/Q sampler comprises:

a sampling device, the sampling device receiving the output of the first filter and sampling the output of the first filter at 4 times the second intermediate frequency;

a delay, delaying one of the in-phase and quadrature phase components of the sampled signal, producing a delayed component and an un-delayed component; and

an adder, the adder receiving the delayed component and the un-delayed component and summing the delayed component and the un-delayed component to produce an input to the quantizer.

5. A radio, comprising:

a first filter, the first filter receiving an input signal, wherein the first filter has a transfer function characterized by steep selectivity and narrow bandpass range and producing a first filtered signal;

an intermediate frequency sampling architecture, the intermediate frequency sampling architecture receiving an input signal, modulating the first filtered signal to an intermediate frequency signal, passing the intermediate frequency signal through a second filter having a bandpass characteristic, but without the steep selectivity characterizing the first filter, producing a second filtered signal anddigitizing the second filtered signal producing a digitized signal;

a baseband converter, the baseband converter converting the digitized signal to a baseband data signal.

6. The radio of claim 5, wherein the intermediate frequency sampling architecture further comprises an amplifier, receiving the output of the first filter and amplifying the input to the modulation.

7. The radio of claim 6, wherein the radio further comprises an I/Q sampler, receiving the second filtered signal, and providing extra selectivity on the signal for input into the quantizer.

8. The radio of claim 7, wherein the I/Q sampler comprises:

a sampling device, sampling the output of the second filter at 4 times the second intermediate frequency;

a delay, delaying one of the in-phase and quadrature phase components of the sampled signal; and

an adder to sum the delayed component and the un-delayed component to produce an input to the quantizer.

9. The radio of claim 5, wherein the radio further comprises a super-heterodyne front end, creating the input signal, comprising:

an antenna, the antenna receiving an input signal via radio frequency in at least IEEE 802.11a or HiperLAN/2 format;

a low noise amplifier, the low noise amplifier amplifying the input signal;

a bandpass filter, the bandpass filter receiving the amplified input signal and filtering the amplified input signal; and

a multiplier, the multiplier receiving the output of the bandpass filter and multiplying the output of the bandpass filter with a first local oscillator to produce the input signal at the first intermediate frequency for input into the intermediate frequency sampling architecture.

10. The radio of claim 5, wherein the conversion to the second intermediate frequency prior to the second filter is a modulation accomplished by multiplying the output of the amplifier by a second local oscillator signal.

11. The radio of claim 10, wherein the radio further comprises a third filter, the third filter receiving the baseband data signal and removing the remaining interference in channels adjacent to the baseband data signal.

12. The radio of claim 11, wherein the first filter is a surface acoustic wave filter.

13. The radio of claim 12, wherein the amplifier is an automatic gain control amplifier, maintaining a relatively constant output level.

14. The radio of claim 13, wherein the second filter is a complex domain filter with a butterworth bandpass characteristic, having a center frequency of 15 MHz and a bandwidth of 17 MHz.

15. The radio of claim 14, wherein the second multiplier multiplies the output of the analog to digital converter by the series 0, 1, 0, -1 to derive the baseband in-phase component signal and by the series 1, 0, -1, 0 to derive the baseband quadrature component signal.

16. A radio, having a receiver comprising:

a first filter, the first filter receiving an input signal, the first filter having a response characterized by steep selectivity and narrow bandpass;

an amplifier, the amplifier amplifying the output of the first filtering device;

a first modulator, the first modulator converting the output of the amplifier to an in-phase signal at a second intermediate frequency;

a second modulator, the second modulator converting the output of the amplifier to a quadrature phase signal at the second intermediate frequency;

a second filter, the second filter receiving the in-phase and quadrature phase signal, the second filter having a bandpass characteristic, without the steep selectivity of the first filtering device;

an I/Q sampler, the I/Q sampler receiving the outputs of the second filter and delaying one of the in-phase and quadrature phase components, before adding them back together;

a quantizer, converting the analog output of the I/Q sampler into a digital signal; and

a third modulator and a fourth modulator, the third and fourth modulators receiving the digital signal and converting it to a baseband in-phase signal and baseband quadrature phase signal, respectively.

17. The radio as defined in claim 16, wherein the radio further comprises:

a third filter, the third filter receiving the baseband in-phase signal and removing the remaining interference in channels adjacent to the baseband in-phase signal; and

a fourth filter, the fourth filter receiving the baseband quadrature phase signal and removing the remaining interference in channels adjacent to the baseband quadrature phase signal.

18. The radio as defined in claim 16, wherein the first filter comprises an intermediate frequency surface acoustical wave filter.

19. The radio as defined in claim 18, wherein the second filter comprises a complex domain filter having a butterworth characteristic, with a center frequency of 15 MHz and a bandwidth of 17 MHz.

20. The radio as defined in claim 19, wherein the amplifier is an automatic gain control amplifier, which keeps the output level nearly constant.

21. The radio as defined in claim 20, wherein the I/Q sampler comprises:

a first and second sampler to sample the in-phase and quadrature phase output of the complex domain filter at a frequency four times the intermediate frequency;

a delay device, the delay device receiving the in-phase sampled signal delaying the in-phase sampled signal for a period of time; and

an adder, receiving the delayed in-phase sampled signal and the sampled quadrature phase signal, the adder adding the sampled delayed in-phase signal to the sampled quadrature phase signal.

22. The radio as defined in claim 21, wherein the delay device is a shift register.

23. The radio as defined in claim 22, wherein the quantizer is an analog to digital converter, operating at a clock frequency equal to the first and second sampler.

24. The radio as defined in claim 23, wherein the first and second modulators are multipliers, multiplying the output of the automatic gain control amplifier by a local oscillator phase-locked loop in order to derive the in-phase and quadrature phase signals.

25. The radio as defined in claim 16, wherein the radio further comprises a transmitter comprising:

a fifth and sixth filter, the fifth and sixth filters receiving a baseband in-phase transmit signal and a baseband quadrature phase transmit signal, respectively, and filtering the in-phase and quadrature phase transmit signals;

a fifth and sixth modulator, the fifth and sixth modulators receiving the output of the fifth and sixth filters, respectively, and converting the output of the fifth and sixth filters from baseband to the second intermediate frequency and adding the signals together;

a digital to analog converter, receiving the output of the fifth and sixth modulators and creating an analog signal;

a seventh modulator, the modulator transforming the analog signal to a first intermediate frequency transmit signal;

a second amplifier, the amplifier amplifying the first intermediate frequency transmit signal;

a seventh filter, the seventh filter receiving the output of the second amplifier, and being characterized by steep selectivity and narrow bandpass;

an eighth modulator, the eighth modulator receiving the output of the seventh filter, and transforming the signal to a transmit frequency; and

a third amplifier, the third amplifier amplifying the output of the eighth modulator to transmission power;

an eighth filter, the eighth filter receiving the output of the third amplifier, the eighth filter having a bandpass characteristic and passing the signal to an antenna for transmission.

26. The radio as defined in claim 25, wherein the fifth and sixth filters are finite impulse response filters.

27. The radio as defined in claim 26, wherein the transmit frequency is in the range of about 5.1 GHz to about 5.9 GHz, the first intermediate frequency is approximately 1.5 MHz, and the second intermediate frequency is approximately 15 MHz.

28. The radio as defined in claim 27, wherein the digital to analog converter is clocked by clock having around a 60 MHz sampling period.

29. The radio as defined in claim 28, wherein the seventh filter is an intermediate frequency surface acoustical wave filter.

30. The radio as defined in claim 29, wherein the third amplifier is a power amplifier driving the signal at saturation.

31. A method for intermediate frequency sampling, the method comprising the steps of:

receiving an input signal;

modulating the input signal to produce an in-phase and a quadrature phase signal at an intermediate frequency;

filtering the intermediate frequency in-phase and quadrature phase signals in a complex domain filter, producing an in-phase and a quadrature phase filtered signal;

adding the in-phase and the quadrature phase filtered signals from the complex domain filter together, yielding a result signal; and

digitizing the result signal, sampling at four times the intermediate frequency.

32. The method as defined in claim 31, wherein the method further comprises the step of filtering the input signal prior to modulating the filtered input signal to an intermediate frequency.

33. The method as defined in claim 32, wherein the method further comprises the step of delaying one of the in-phase and quadrature phase filtered signals from the complex domain filter prior to adding said signals together to obtain a result.

34. A method for receiving a radio signal, the method comprising the steps of:

receiving an input signal;

filtering the input signal in a first filter having a response characterized by a steep selectivity and a narrow bandpass;

modulating the signal to produce an in-phase and a quadrature phase signal at an intermediate frequency;

filtering the intermediate frequency in-phase and quadrature phase signals in a channel selection filter, producing an in-phase and a quadrature phase filtered signal;

adding the in-phase and the quadrature phase filtered signals from the channel selection filter together, yielding a result signal;

digitizing the result signal; and

modulating the digitized signal from the intermediate frequency to obtain a baseband in-phase data signal and a baseband quadrature phase data signal.

35. The method as defined in claim 34, wherein the method further comprises the step of filtering the baseband in-phase and baseband quadrature phase data signals to remove unwanted adjacent harmonics from the baseband in-phase and the baseband quadrature phase data signals.

36. The method as defined in claim 35, wherein the method further includes the step of I/Q sampling the signal after it is filtered in the channel selection filter prior to digitizing the result signal.

37. The method as defined in claim 36, wherein the I/Q sampling method comprises the steps of sampling the in-phase and quadrature phase signals, delaying the in-phase signal, and adding the signal together.

38. The method as defined in claim 34, wherein the intermediate frequency is about 15 MHz.

39. The method as defined in claim 38, wherein the first and second modulators use a local oscillator phase-locked loop to generate the intermediate frequency.

40. The method as defined in claim 39, wherein the modulating to baseband is performed by modulating the quantized signal with a 0, 1, 0, -1 sequence to obtain the baseband in-phase data signal and modulating the quantized signal with a 1, 0, -1, 0 sequence to obtain the baseband quadrature phase data signal.

41. The method as defined in claim 27, wherein the method further comprises a method for transmitting a radio signal comprising the steps of:

receiving an in-phase transmit signal and a quadrature phase transmit signal in baseband;

transforming the in-phase and quadrature phase transmit signals from baseband to a second intermediate frequency and adding the signals together to get a digital signal;

converting the digital signal to an analog signal;

converting the analog signal from the second intermediate frequency to a first intermediate frequency;

amplifying the first intermediate frequency analog signal;

filtering the amplified signal in a filter having a response characterized by steep selectivity and a narrow bandpass; and

converting the filtered amplified signal from the first intermediate frequency to a transmit frequency signal.

42. The method as defined in claim 41, wherein the method further comprises filtering the in-phase and quadrature phase transmit signals before transforming the signal from baseband to a second intermediate frequency

43. The method as defined in claim 42, wherein the method further comprises:

filtering the transmit frequency signal at transmit frequency in a bandpass filter;

amplifying the filtered transmit frequency signal to transmission power;

filtering the amplified transmit signal; and

transmitting the signal.

44. The method as defined in claim 43, wherein the transforming to baseband is performed according to a transformation method comprising the steps of multiplying the in-phase signal by a 0, 1, 0, -1 sequence and multiplying the quadrature phase signal by a 1, 0, -1, 0 sequence, before adding the in-phase and quadrature phase signals together.

45. The method as defined in claim 44, wherein the second intermediate frequency is about 15 MHz, the first intermediate frequency is about 1.5 GHz, and the transmit frequency is in the range of about 5.1 GHz to about 5.9 GHz.

46. The method as defined in claim 45, wherein the filtering characterized by steep selectivity and narrow bandpass is an intermediate frequency surface acoustical wave filter.

47. The method as defined in claim 46, wherein the amplifying of the filtered signal is performed by a power amplifier in saturation.

48. A radio system having a receiver, comprising:

means for intermediate frequency sampling, comprising:

a means for first filtering an input signal, said first filtering means being characterized by steep selectivity and narrow bandpass;

a means for modulating, modulating the filtered signal to a second intermediate frequency; and

means for second filtering of the second intermediate frequency signal, said second filtering means being characterized by a bandpass transfer function, without the steep selectivity provided by the first filtering means;

means for adding the in-phase and quadrature phase component results of the second filtering means together;

means for quantizing the result of the adding means; and

means for transforming the quantized signal into a wanted baseband data signal in in-phase and quadrature phase components.

49. The radio system as defined in claim 48, wherein the system further comprises a third filtering means, said means receiving the wanted in-phase and quadrature phase baseband data signal components and filtering the adjacent harmonics out of the wanted in-phase and quadrature phase baseband data signal components.

50. The radio system as defined in claim 49, wherein the system further comprises a super-heterodyne front end creating the input signal, the super-heterodyne front end comprises:

means for selecting the input band;

means for amplifying the input band signal, which avoids adding noise;

means for fourth filtering, having a bandpass characteristic; and

means for modulating the result of the filter to obtain the input signal at a first intermediate frequency.

51. The radio system as defined in claim 50, wherein the input frequency is in the range of about 5.1 GHz to about 5.9 GHz, the first intermediate frequency is approximately 1.5 GHz, and the second intermediate frequency is about 15 MHz.

52. The radio system as defined in claim 51, wherein the radio further comprises a means for amplifying the output of the first filtering means prior to being input into the modulating means.

53. The radio system as defined in claim 48, wherein the radio further comprises an I/Q sampling means, receiving the output of the second filtering means and providing extra selectivity of the filtered signal prior to the quantizing means.

54. The radio system as defined in claim 53, further comprising a transmitter comprising:

means for inputting a transmit signal having an in-phase and a quadrature phase component in baseband;

means for sixth filtering, receiving and filtering the in-phase component and the quadrature phase component of the transmit signal;

means for first modulating the output of the sixth filtering means from baseband to the second intermediate frequency and combining the transformed components;

means for converting the output of the first modulation to an analog signal;

means for second modulating the frequency of the analog signal to a first intermediate frequency;

means for first amplifying the output of the second modulation means;

means for seventh filtering, the means being characterized by steep selectivity and narrow bandpass, and the means filtering the output of the first amplification means;

means for third modulating the output of the seventh filtering means to the transmit frequency;

means for eighth filtering of the third modulating means output, having a bandpass characteristic;

means for second amplifying of the output of the ninth filtering means, amplifying the signal to transmit power;

means for ninth filtering of the second amplified signal; and

means for transmitting the signal.